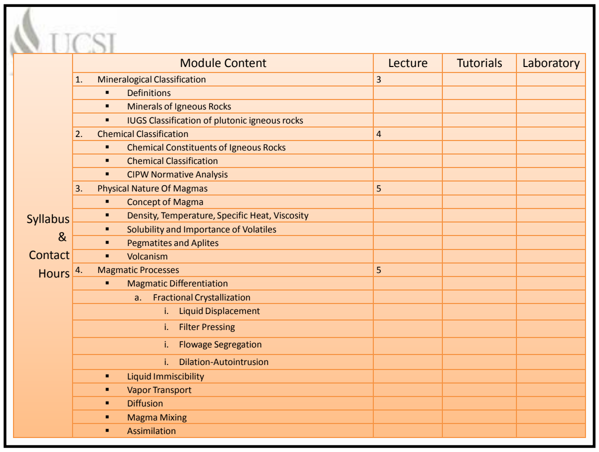
Igneous , Metamorphic and Sedimentary Petrology
EG203

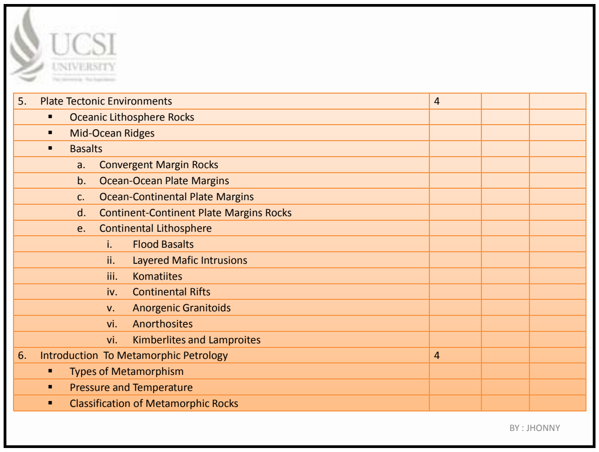
Course Outline

Subject Name	Igneous , Metamorphic and Sedimentary Petrology
Subject Code	EG 203
Status	major
Credit Hours	4
Semester / Year	1-2
Pre-requisite	none
Teaching Method	Lectures + laboratory experiments
Assessment	
Test 1	10%
Mid Term Examination	20%
Test 2	10%
Laboratory	10%
Final Examination	50% The course has five assessment components as described above. Test 1: it will be conducted on week 5 of the semester. The test 1 will usually have 4 questions of approximately 15 minutes duration each. Midterm exam: it will be conducted on week 9 of the semester. The midterm exam will have 4 questions of approximately 20 minutes duration each. Test 2: will be conducted on week 12 of the semester. The test 2 will usually have 4 questions of approximately 15 minutes duration each. Laboratory component: it is compulsory to attend all the lab sessions; failing to do so will result in complete failure in the subject. The student will carry out the experiments described below and submit a report to the lab tutor at the end of the semester. Final Exam component: it will consist of 5 questions of 3 hours duration.
40% ruling:	Applicable
Supplementary exam:	Applicable (on the final exam only)

Objectives	The course aims to teach the following topics : 1. Examination of materials from which the Earth is made. 2. Techniques of identifying and interpreting these materials. 3. Physical processes that operate in the Earth' interior; i.e., igneous and metamorphic processes and processes leading to earthquakes 4. Physical processes that operate on and near the Earth' surface such as: ➢ Weathering ➢ Erosion ➢ Deposition ➢ Groundwater 5. Theory of Plate Tectonics and the evidence supporting it. 6. Interactions between on going geologic processes and humans
Learning Outcome	Upon completion of this module , student should be able to : 1. Acquire: ➢ Skills for the identification, description, and classification of igneous and metamorphic rocks. ➢ Skills for the interpretation of field structures, textures and mineral assemblages. ➢ Skills for the synthesis and interpretation of compositional variations of igneous and metamorphic rocks. 2. Appreciate the changes that occur within the deep parts of the Earth (the lithosphere and asthenosphere) and how deep processes affect the dynamic evolution of the Earth as a system. 3. Have ability to : ➢ Select appropriate data from a range of sources and develop appropriate research strategies using personal observational, descriptional, and numerical skills. ➢ Take responsibility for own learning with minimum direction.

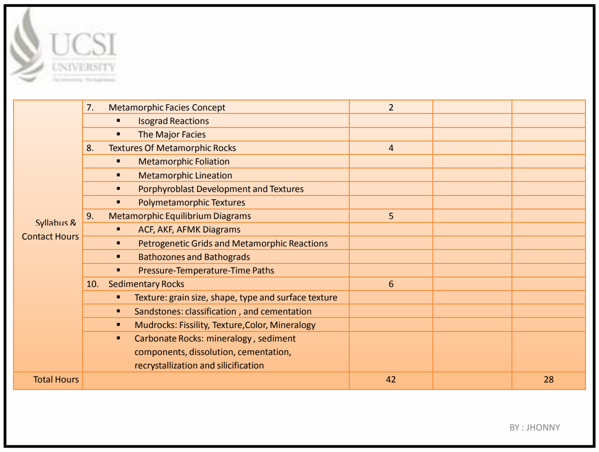


	Module Content	Lecture	Tutorials	Laboratory
Syllabus & Contact Hours	1. Mineralogical Classification	3		
	▪ Definitions			
	▪ Minerals of Igneous Rocks			
	▪ IUGS Classification of plutonic igneous rocks			
	2. Chemical Classification	4		
	▪ Chemical Constituents of Igneous Rocks			
	▪ Chemical Classification			
	▪ CIPW Normative Analysis			
	3. Physical Nature Of Magmas	5		
	▪ Concept of Magma			
	▪ Density, Temperature, Specific Heat, Viscosity			
	▪ Solubility and Importance of Volatiles			
	▪ Pegmatites and Aplites			
	▪ Volcanism			
	4. Magmatic Processes	5		
	▪ Magmatic Differentiation			
	a. Fractional Crystallization			
	i. Liquid Displacement			
	i. Filter Pressing			
	i. Flowage Segregation			
	i. Dilation-Autointrusion			
	▪ Liquid Immiscibility			
	▪ Vapor Transport			
	▪ Diffusion			
	▪ Magma Mixing			
	▪ Assimilation			



5. Plate Tectonic Environments	4		
▪ Oceanic Lithosphere Rocks			
▪ Mid-Ocean Ridges			
▪ Basalts			
a. Convergent Margin Rocks			
b. Ocean-Ocean Plate Margins			
c. Ocean-Continental Plate Margins			
d. Continent-Continent Plate Margins Rocks			
e. Continental Lithosphere			
i. Flood Basalts			
ii. Layered Mafic Intrusions			
iii. Komatiites			
iv. Continental Rifts			
v. Anorgenic Granitoids			
vi. Anorthosites			
vi. Kimberlites and Lamproites			
6. Introduction To Metamorphic Petrology	4		
▪ Types of Metamorphism			
▪ Pressure and Temperature			
▪ Classification of Metamorphic Rocks			

BY : JHONNY



Syllabus & Contact Hours	7. Metamorphic Facies Concept	2		
	▪ Isograd Reactions			
	▪ The Major Facies			
	8. Textures Of Metamorphic Rocks	4		
	▪ Metamorphic Foliation			
	▪ Metamorphic Lineation			
	▪ Porphyroblast Development and Textures			
	▪ Polymetamorphic Textures			
	9. Metamorphic Equilibrium Diagrams	5		
	▪ ACF, AKF, AFMK Diagrams			
	▪ Petrogenetic Grids and Metamorphic Reactions			
	▪ Bathozones and Bathograds			
	▪ Pressure-Temperature-Time Paths			
	10. Sedimentary Rocks	6		
	▪ Texture: grain size, shape, type and surface texture			
	▪ Sandstones: classification , and cementation			
	▪ Mudrocks: Fissility, Texture,Color, Mineralogy			
	▪ Carbonate Rocks: mineralogy , sediment components, dissolution, cementation, recrystallization and silicification			
Total Hours		42		28

BY : JHONNY

Textbook	Simon & Schuster's Guide to Rocks and Minerals, by Simon & Schuster, Publisher: Simon & Schuster (10/01/1978), ISBN: 0671244175ISBN13: 9780671244170
Reference Books	1. Smithsonian Handbooks: Rocks & Minerals, by Chris Pellant, Publisher: DK ADULT; 1st edition (September 1, 2002) , ISBN-10: 0789491060 ,ISBN-13: 978-0789491060 . 2. The Practical Geologist: The Introductory Guide to the Basics of Geology and to Collecting and Identifying Rocks, by Dougal , Publisher: Fireside (August 15, 1992), ISBN-10: 0671746979, ISBN-13: 978-0671746971

Class Rule

1. No class in public holiday.
2. Maximum 15 minutes late and I will inform the class for the delay.
3. I will inform the class if I can not come to the class and replacement class to be scheduled and discussed.
4. Let us help each other to achieve the objectives.

Introduction

Structure of The Earth and Rock

ROCK :

- Solid aggregates that composed by minerals
- Solid aggregates that consist of minerals, glasses, alteration of the organic material, and combination of those component.

PETROLOGY :

- Science that study of rocks
- Science of rocks: petro-genesis, petro-graphic

ROCK CLASSIFICATION:

Three type of rocks :

- Igneous rock
- Sedimentary rock
- Metamorphic rock

Earth

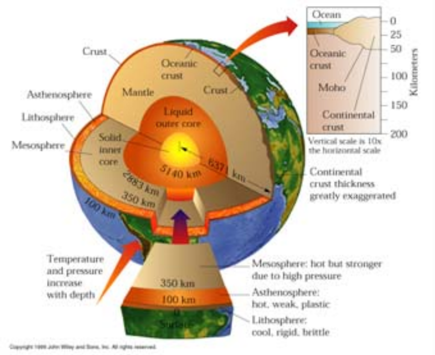
Consisting of several solid and liquid layers:

Earth crust: 0-30 km or more)
------------------------------------ Mohorovicic
Mantle: the top and bottom: till 2900 km
--Guttenberg
Earth core:
outer core: 2900 - 5155 km
--- Lehmann
inner core: 5155 - 6371 km

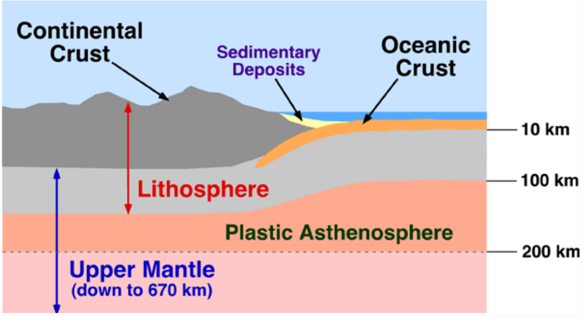
Lithosphere: 0 - 150 km
→ crust and mantle

Astenosphere: 150-640 km
→ composed of partially melted mantle

Mesosphere: 640 km - deeper
→ elastics zone


Crust
Oceanic crust
Crust
Mantle
Asthenosphere
Lithosphere
Mesosphere
Liquid outer core
Solid inner core
5140 km
6371 km
2883 km
350 km
100 km
Ocean
Oceanic crust
Moho
Continental crust
0
25
50
100
150
200
Kilometers
Vertical scale is 10x the horizontal scale
Continental crust thickness greatly exaggerated
Temperature and pressure increase with depth
350 km
100 km
0
Surface
Mesosphere: hot but stronger due to high pressure
Asthenosphere: hot, weak, plastic
Lithosphere: cool, rigid, brittle

Copyright 1999 John Wiley and Sons, Inc. All rights reserved.



BY : JHONNY

DISTRIBUTION OF ROCK IN THE EARTH:

- Metamorphic rocks: inner core, mantle, Earth's lower crust
- Igneous rock: the upper crust
- Sedimentary rocks: in or near the surface of the earth

On land:

66% sedimentary rocks, 34% crystalline rocks

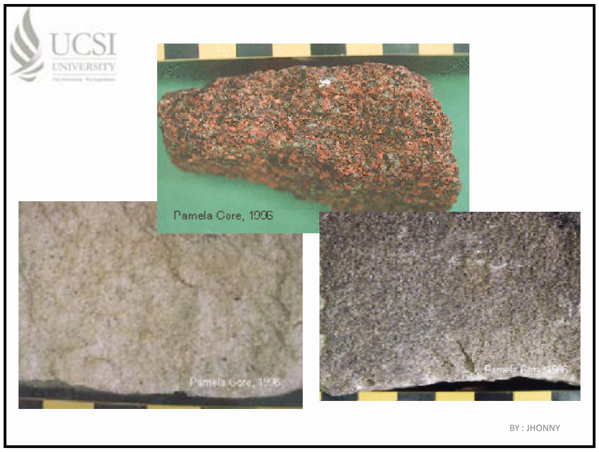
In the ocean or sea:

sedimentary rocks and sediments (at the top), crystalline rock (igneous and metamorphic rocks in the bottom)

BY : JHONNY

BY : JHONNY

BY : JHONNY

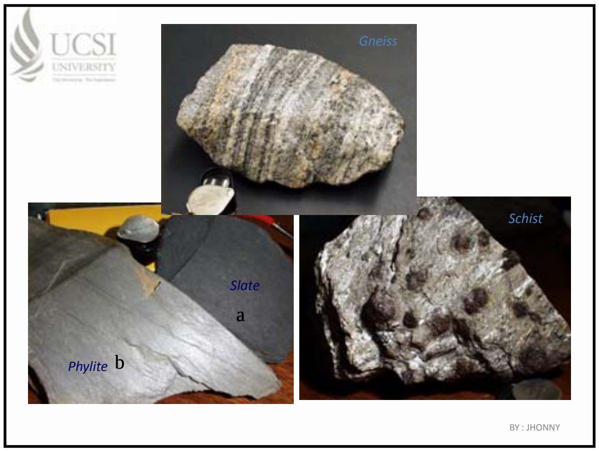


Pamela Gore, 1996

Pamela Gore, 1996

Pamela Gore, 1996

BY : JHONNY



BY : JHONNY

UCSI
UNIVERSITY

Thank You
To be continue
Wed 5th Jan 2011

BY : JHONNY